

Avery-McLeod-McCarty Experiment

Offspring inherit traits from their parents. But what molecule confers such inheritable information? In 1944, Oswald Avery, Colin Macleod, and Maclyn McCarty reported a now famous experiment that showed that DNA is molecule that could transform and allow bacteria to acquire a new trait. This result was surprising, because most people thought that proteins, not DNA, were the molecules that conferred heredity. DNA transformation became the basis of the biotechnology industry. See also the XBio video on the 1952 Hershey Chase experiment, which provided additional evidence in favor of DNA being the hereditary material. For more information, see Ronald Vale's Narrative on DNA Structure in The Explorer's Guide to Biology (explorebiology.org/collections/genetics/dna-structure).

Do you have the same color eyes as your mom or the same hair color as your dad ? Just by observing our appearance, we get a sense that some traits are heritable. They get passed on from parent to offspring. But how does heritable information get transmitted from one generation to the next ? In the 19 forties, this was a complete mystery. We're going to tell you the story of three scientists Oswald Avery, Colin MacLeod and Maclyn McCarty who set out to solve this. They're pioneering research provided proof that deoxyribonucleic acid, or DNA, contains the blueprint of who we are and what we look like. That DNA is, in fact, the heritable information. This finding may seem obvious now. Back in the 19 forties, it was incredibly controversial. Most scientists thought that DNA was too simple to contain all of the information for every single heritable trait, and instead they thought proteins, which are large and complex molecules, must be the substance passed on from parent to child. At the start of the story or three scientists wanted to follow up on an important finding from a scientist named Frederick Griffith. Griffith worked with a type of bacteria that came in two strains, one that looked smooth and one that looked bumpy. If he injected the smooth strain into mice, they died. But if he injected the rough strain, the mice lived, to his surprise. If he first killed the smooth bacteria, the dead bacteria did not kill the mice. But if he injected a mixture of dead, smooth bacteria in live rough bacteria, the mice died. This meant that amazingly, something from the smooth strain was transferred to and permanently inherited by the rough strain. The process he called transformation, and this caused the rough bacteria to become deadly. This exciting finding left a big puzzle that Avery MacLeod and McCarty wanted to solve. What was inheritable information that caused the transformation of the rough strain into the deadly smooth bacteria. The scientist purified a chemical substance from the smooth bacteria, and they repeated Griffith's results with it when they applied the substance to the rough bacteria. Those rough bacteria transformed into smooth bacteria, and this trait was heritable and permanent. But the question remained what type of molecule was this heritable information ? At the time, most people, including Avery, I thought the answer was

protein. But they found that enzymes that destroyed proteins could not block the activity of substance. It's still made. Ref bacteria looks smooth. This meant the substance was not her teen, So could it be DNA ? Instead, when they added an enzyme that destroys DNA but does not destroy protein, transforming activity disappeared. Avery and colleagues confirmed that the heritable information had a chemical signature that matched DNA and that their preparation had very little contaminating protein or other molecules. Researchers came to the surprising conclusion that DNA was, in fact, the heritable information. Despite the beautiful evidence from these experiments, many scientists questioned whether some contaminating protein might account for the results. It took another experiment by Hershey and Chase in 1952 described in another video and the discovery of the double helix structure of DNA in 1953 to convince everyone beyond any doubt that DNA is the molecule of charity. Once people were convinced that DNA was inheritable information, it sparked a wave of new research questions that served as the foundation for biotechnology revolutionizing modern medicine. Many new treatments for human diseases rely on our ability to work with DNA and even pass genetic information from organism to organism. One impactful example is in treating patients with Type one diabetes who require daily insulin injections. Previously, insulin from life stock was used. But now human insulin DNA is transferred to bacteria, which act as biological factories to produce human insulin for patients. So the early discovery of DNA transformation by Avery MacLeod and McCarty has had long lasting benefits for humankind.

<https://explorebiology.org/videos/dna-transformation-experiment>